We find it more difficult to follow the author in his discussion of the remedies to be adopted in order to halt the apparent degeneration of European populations. He quotes various examples of legislation, notably in the United States of America and in Japan, concerning the voluntary or compulsory sterilization of individuals suffering from hereditary mental diseases or defects. He suggests, therefore, that similar legislation is desirable for those families where the intelligence is low and where offspring might be expected to inherit poor or defective mental characteristics. Mr. Winter is concerned with differentiating between legislation passed by the Hitler régime in this field and similar legislation which he and other German authorities now advocate, but we find it difficult to understand this, since we are given no firm guide as to what the author considers to be poor intelligence, and by what criteria he would permit the State to carry out compulsory sterilizations of its citizens, without infringing either upon the rights of the individual or the State's moral obligations to its citizens.

This essay is obviously sincere and reflects the genuine concern of the author, but is not likely to find many sympathetic readers in this country.

J. CARLEBACH

INTELLIGENCE AND EDUCATION

McIntosh, Douglas M. *Educational Guidance and the Pool of Ability.* London 1959. University of London Press. Pp. 199. Price 21s.

DR. MCINTOSH, the Director of Education in Fife, describes in this book a very complete investigation he has made of the efficiency with which pupils were allocated to different types of secondary school course, academic and practical, in that authority. His chief criteria of success was the achievement in the School Leaving Certificate taken at the end of the secondary school course.

The selection in Fife is based on an aggregate mark taken at "eleven plus" in two intelligence tests, an English test, an arithmetical test, and scaled teachers' estimates for English and arithmetic. The results are very much the same as in similar inquiries in England. The selection procedure is on the whole remarkably successful as judged by school leaving examinations five or six years later. Of the individual tests, the most successful in predicting success in the grammar school courses were the English test and the teachers' estimate in English; the intelligence tests came next. For the more practical courses, the arithmetic tests were the best predictors of later achievement. in discussing anomalous cases, Dr. McIntosh stresses the importance of home background. On the rare occasions where the parents of an able child did not wish the child to take an academic course, but were persuaded by head teachers to change their minds, the child in spite of its ability did not stay to take a school leaving certificate.

Dr. McIntosh is rightly concerned with the extent to which potentially able children are being missed by the selection procedure. In a chapter entitled "The Pool of Ability" he draws attention to the shortage of highly educated manpower, which is affecting many aspects of our national life. "Education is suffering because of the lack of highly qualified teachers, developments in atomic energy are being retarded because of the scarcity of mathematicians and scientists, industry is in urgent need of engineers." It is noteworthy that the need is greatest for mathematicians and scientists, and it is for examination success in these subjects that prediction in the "eleven plus" tests is least reliable. One suspects that a number of potentially successful scientists and engineers are lost because their lack of verbal ability places them below the pass mark line at the selection procedure. Dr. McIntosh quotes some examples of such boys who managed to secure a late transfer to an academic course from a practical course and did well in science and mathematics. There is clearly a strong case for research to devise better tests for predicting success in mathematics and science. The "eleven plus" examination, usually taken in England at "ten plus", can include no mathematics as the children in primary schools are not taught any, and tests of arithmetic are, if anything, less successful than the other tests in picking future mathematicians.

Finally, it is worth noting that while the con-

cept of the "pool of ability' is a useful one, Dr. McIntosh estimates that something like 16 per cent of the school population are capable of following an academic course successfully, this pool is not necessarily a static one. In each fresh generation, even making full allowance for genetic stabilising mechanisms such as heterozygote advantage, the pool of ability will be modified by differential fertility and assortative mating for the genes underlying ability in the preceding generation.

C. O. C.

BLOOD

Jonxis, J. H. P. and **Delafresnaye, J. F.** (Editors). *Abnormal Haemoglobins: A Symposium organized by The Council for International Organizations of Medical Sciences. Established under the Joint Auspices of UNESCO and WHO.* Oxford, 1959. Blackwell. Pp. ix+427. Price 45s.

IN FEW SUBJECTS has there been such an increase in the volume of contributions as there has been each year in the field of abnormalities of human haemoglobin synthesis. There are a number of explanations, not the least of which is, perhaps, one given by Professor Jonxis of Gröningen: Haemoglobin is virtually the only human protein which can be prepared in a fairly pure state by relatively simple procedures. Red cells are washed with saline to remove the plasma proteins. They are then lysed with water, and the haemoglobin goes into solution, while the stroma and cell envelopes can be removed by centrifugation. By this simple procedure a 99 per cent pure haemoglobin solution can be obtained. The discovery that sickle-cell anaemia was due to an abnormal haemoglobin led Linus Pauling to the concept of "molecular disease". The inheritance of variations of haemoglobin synthesis follows a simple Mendelian pattern and, by means of the sickle-cell test and clinical assessment, homozygotes and heterozygotes for the abnormal sickle-cell gene could, in some way, be differentiated. Following Linus Pauling's discovery of the difference between electrophoretic behaviour of normal and sickle-cell haemoglobin, they can, however, be recognized, subject to certain well-defined exceptions, with certainty by electrophoretic examination of their blood. The heterozygote shows both normal adult haemoglobin (haemoglobin A) and sickle-cell haemoglobin (haemoglobin S). The homozygote does not possess normal adult haemoglobin, and the only adult variant found is haemoglobin S. Electrophoresis led to the discovery of numerous other haemoglobin variants, of which only one—haemoglobin H—can, like haemoglobin S, be discovered by submitting the red cells to a simple laboratory test. Haemoglobin H containing cells can be shown to produce, under suitable conditions, typical inclusion bodies. The different disease states—of which the homozygous sickling condition is the most severe—have been of interest to medicine. Furthermore, the fact that in sickle-cell anaemia homozygotes usually die before they reach the age of puberty, and that at the same time the incidence of heterozygotes remains high, has led to the first proof of balanced polymorphism being at work in the natural selection of man. In highly malarious regions, the sickling heterozygote has a survival advantage over the sickling homozygote because he does not die from sickle-cell anaemia; and over the normal homozygote because he is less likely to die from cerebral malaria. Of special interest to the geneticist is that there is now a possibility that the action of a single gene might be elucidated by examining chemical differences between allelomorphic haemoglobins.

The world distribution of the haemoglobin variants has been of profound interest to the anthropologist. There is the sickle-cell haemoglobin largely associated with Africa, south of the Sahara and north of the River Zambesi, but also found in certain primitive communities of Arabia and India. There is haemoglobin E in Thailand, Burma, Malaya and in the surrounding areas. Another genetically determined abnormality is thalassaemia (Mediterranean anaemia) in which haemoglobin A formation is suppressed without the appearance of an abnormal adult haemoglobin. This condition, originally so-called because it was thought to be typical for Greeks and Italians, is now known to occur widely in the Middle East, India and S.E. Asia. Perhaps of even greater interest to the anthropologist are the haemoglobins which—some at a lesser frequency—occur in more cir-